

GREEN MATTERS

A newsletter from the Alberta Environmentally Sustainable Agriculture Council

From AESA Council's Chair

by John Kolke,
Poultry Industry Council

"Natural capital includes resources such as minerals, timber, oil and gas which provides the raw materials used in the production of manufactured goods. However, it also includes the land and water resources that anchor our quality of life and support economic activity such as agriculture, forestry, tourism, and recreation. Further more, natural capital includes living ecosystems – grasslands, oceans and forests – that cleanse fouled air and water, reinvigorate soil and contribute to a predictable, stable climate."

–From "Western Canada's Natural Capital" by Barry Worbets, Canada West Foundation

WHAT'S INSIDE

Working with Microbial Diversity

Preserving Diversity
in Agriculture

Invasions that
Choke out Diversity

Council Profiles:
ACPC and AFPA

The Science of Sustainability -
A Fuller Perspective

Issue No.17, Fall 2003

Biodiversity: The Challenge of Conservation

Of the four major issues that the Alberta Environmentally Sustainable Agriculture (AESA) Council focuses on – air, water, soil and biodiversity – the one we have the most difficulty with is biodiversity. We value biodiversity, but we face important challenges to sustaining it.

I think many farmers and ranchers most appreciate biodiversity when they walk in a favourite landscape. My family and I recently hiked along the Oldman River upstream from the Nolan Bridge. The valley was full of life – a burrowing owl on a cedar post, an island nesting area for a flock of pelicans, a bald eagle in a dead cottonwood, wild onions in bloom and prickly pear cactus.

Along with providing a home for many grassland species, the Oldman River valley holds and cleans our water, cleans our air, and stores carbon. Yet it is also a "working landscape" for cow-calf operations, hikers, canoeists, utility crossings, and the gas and oil sector. It is part of our natural capital.

Although ranchers and farmers appreciate biodiversity, they also make their living on the landscapes that support it. And that is where values can collide. Maintaining habitat can be a cost that an individual landowner bears for all Albertans' benefit.

An important first step to help farmers and ranchers conserve biodiversity is getting the information to them on how working landscapes can support biodiversity. Various organizations are involved in such efforts. For example, AESA Council partners with agencies like Ducks Unlimited Canada on projects that conserve

habitat and benefit agriculture. Also, there are two upcoming conferences this winter that focus on this issue: the 7th Prairie Conservation and Endangered Species Conference on February 26 to 29, 2004 in Calgary and "The Value of Biodiversity in Agriculture" is the theme of the next AESA Council Conference that will be held on March 2 to 3, 2004, at the Royal Executive Inn in Leduc.

A good next step is to understand the barriers preventing producers from doing more to sustain biodiversity. A recent survey by the conservation agency Operation Grasslands Community found that the main barriers are financial constraints, time and the need for information.

Results from surveys like this should be used to develop and improve programs at the local, provincial and federal levels. Maintaining our rich legacy of natural capital will require ranchers and farmers working together with support from conservation groups and the public.



Old Man River

The Web of Life in a Tiny World

“The whole microbial community around those roots is very much plant-growth-promoting and detrimental to pathogens.”

“The soil is a system, a world, and when we affect one part of it, it has all these other cascading effects,” says Dr. Jill Clapperton, a rhizosphere ecologist with Agriculture and Agri-Food Canada (AAFC). The rhizosphere is that portion of the topsoil composed of roots and the soil around the roots. It teems with tiny organisms like soil mites, nematodes, bacteria and fungi. Their diverse interactions shape their world. And when this world is thriving, it contributes to higher crop yields, reduced inputs, more nutritious food and a healthy environment.

For instance, mycorrhizae are specialized fungi that require a plant host to survive. So they focus on making sure their plant gets the light, water, space and nutrients it needs to grow and reproduce. “The mycorrhizae extend their hyphae – the silky filaments that make up their body – well beyond the plant’s roots to obtain water and nutrients for the plant,” says Clapperton. They also bring about an array of other helpful changes.

“Once a mycorrhiza has colonized a plant root, the plant photosynthesizes more rapidly; it has more sugars, amino acids and organic acids going into its root system. That means all the organisms living in and around the roots get fed more goodies. So their activity goes up and they start producing, in some cases, even hormones important for plant growth for better rooting. The whole microbial community around those roots is very much plant-growth-promoting and detrimental to pathogens.”

Clapperton’s research shows zero tillage and diverse crop rotations lead to increased activity by all sorts of beneficial soil organisms. For mycorrhizae, it’s also important to limit phosphorus fertilizer applications because, if

phosphorus fertilizer is available, plants tend to use it and inhibit the growth of mycorrhizae.

“Alberta soils have an abundant amount of phosphorus but it’s bound. The mycorrhizae tap into that bound phosphorus,” says Clapperton says. “For example in wheat, [if we apply only enough phosphorus to replace the amount removed with the previous crop], and take advantage of the mycorrhizal colonization, we have increased the micronutrient, phosphorus and calcium content in the grain, compared with grain grown with what would be considered an adequate level of applied phosphorus.”

Yet most crops are bred using fertilizer, in many cases at “luxurious” rates, notes Clapperton. This approach selects for varieties that rely on fertilizer rather than mycorrhizae. She says, “It’s really important for all of us to think about that a little bit more.”

Fibre-feasting bacteria for dairy cattledairy cattle

Another world within a world is the microbial ecosystem found in a cow’s rumen, the first stomach in its four-stomach digestive system. Microbiologist Dr. Johanne Chiquette of AAFC and her research team are looking into this world, with the help of molecular biology and a moose.

Chiquette hopes to increase the ability of dairy cattle to get energy from fibre in their diets, so they will need less grain, the expensive part of the ration. One of her current projects, funded by the Dairy Farmers of Canada, is investigating the effects on fibre digestion of introducing moose rumen bacteria into a cow’s rumen.

Chiquette suspected that animals in the wild might have more diverse rumen microbial populations than dairy cattle because of the diversity of microorganisms and food sources in the natural environment. She selected moose because their diet of bark and tree shoots requires rumen bacteria that excel at digesting fibre.



A soil mite: one tiny part of our diverse world.

The researchers isolated and identified a strain of bacteria from a moose’s ruminal fluid that outperformed all the other fibre-digesting organisms they tested. She says, “This strain belongs to a species of bacteria that already exists in the dairy cow, but it’s a different strain, so it’s like a cousin.”

The researchers inoculated two groups of dairy cattle, one on a forage-rich diet and the other on a grain-rich diet, with the new strain. They also monitored microbial populations and rumen characteristics affecting microbial activity before, during and after the four-week inoculation period.

The arrival of a new microbe in the rumen can trigger various actions and reactions as the organisms duke it out for a place in their world. Although the new strain did not persist after inoculation, its population gradually increased during the inoculation period. This suggests to Chiquette that the new strain might become established under slightly different conditions, for example by lengthening the inoculation period.



This moose rumen bacterium could help dairy cattle get more energy from fibre.

Treasure Trove of Diversity

**"[Germplasm] in our collection may stimulate new jobs,
new forms of plant breeding, new areas of science
and biotechnology."**

"Preservation of genetic resources has such broad implications for world societies, including Canadian society," says Dr. Ken Richards, Manager of Plant Gene Resources of Canada (PGRC). "It influences our economy now and in the future, and our social well being. Things that we find in our collection may stimulate new jobs, new forms of plant breeding, new areas of science and biotechnology. And we play an increasingly important role in the international community by helping to conserve world germplasm."

PGRC, an agency of Agriculture and Agri-Food Canada, is located in Saskatoon. It coordinates a network of centres and staff that make up Canada's Plant Germplasm System. This system acquires, conserves and evaluates the genetic diversity of crop plants, their wild relatives and Canadian native plant species. It also provides germplasm – the seed or other parts of a plant from which new plants can be grown – to plant breeders and researchers around the world.

Germplasm from other countries is key to Canadian agriculture. Most of our major crops originated elsewhere. For instance, wheat is from the Near East, and alfalfa is from Turkey. PGRC and other germplasm collections continue to provide infusions of genetic diversity to help breeders develop varieties with qualities like disease resistance, high protein content, or characteristics needed for non-food products.

Included in PGRC's more than 110,000 seed samples are several "world base" collections. Richards explains, "Canada has accepted world responsibility for the long-term conservation and preservation of barley and oat germplasm for the world. We have also accepted responsibility for maintaining backup world base collections of pearl millet and oilseed crucifers." As older crop varieties fall into disuse with the arrival of more productive varieties and as habitats for the wild relatives of crops disappear, the role of world base collections becomes increasingly important.

Along with its focus on crop germplasm, PGRC is also actively expanding its collection of native Canadian plants. "Obviously it's best to conserve our native plants in their native habitats. But where those habitats are at risk, it's important to have material conserved in a gene bank," says Richards.

More information on PGRC is available at http://pgrc3.agr.gc.ca/index_e.html.

Wanted: Good homes for rare farm animals

Agriculture and Agri-Food Canada is currently co-chairing a multi-stakeholder committee to discuss establishing a genetic resources conservation program for Canadian farm animals. In the meantime, several agencies are

working hard to preserve our heritage breeds. One of these agencies is Rare Breeds Canada (RBC), and its Host Farm Program offers a way for individual farmers to play a part in preserving rare breeds.

Under this program, RBC members apply to raise breeding groups of rare animals. When a breeding group becomes available, a contract between RBC and the selected host farm is drawn up, defining the arrangement. The host farm is responsible for all maintenance costs of the animals. In exchange, the farm keeps a specific percentage of the offspring, depending on the type of animal.

Judy Fitzsimons is RBC's Alberta Chapter representative. She participated in the Host Farm Program a few years ago, raising Jacob Sheep, an unusual-looking smaller breed, with spotted wool and up to six sets of horns.

Fitzsimons believes the genetic traits found in the older breeds are an important resource for today's farm animals. She says that although today's breeds often produce large amounts of meat, milk or eggs, they sometimes lack valuable traits found in the older breeds, such as disease resistance and the ability to do well on poor pastures.

Currently on their farm near Rimbey, the Fitzsimonses have an amazing variety of rare breeds including Highland Cattle, Kerry Cattle, Jacob Sheep, Cotswold Sheep, Shropshire Sheep, Soay Sheep, Fainting Goats, Berkshire Pigs, a Newfoundland Pony, Bourbon Red Turkeys and a variety of chicken breeds.

Preserving these rare breeds enriches Fitzsimons' life in many ways. Perhaps most important is "the knowledge that you are doing something good for the world, that you are saving the breed," she says. She also likes the quality of the animals' meat, milk, wool and eggs, she enjoys the unique appearance of many of the breeds, and she's fascinated by the breed histories.

More information about Rare Breeds Canada and its Host Farm Program is available at <http://www.trentu.ca/rarebreedsCanada>.



A Jacob sheep

Alien Invaders

in Riparian Areas



photo: John M. Randall/
The Nature Conservancy

Saltcedar

"We need to take a very proactive approach toward risk assessment and prevention of introduction of invasive alien species."

Healthy riparian areas provide many benefits to agriculture and the environment. However, riparian habitats are at risk when invaded by aliens. No, not little grey beings from outer space, but certain plants from other countries – adaptable, aggressive plants with a high reproductive capacity and no natural enemies in their adopted home. And some of these plants may be hiding in your garden.

Alberta Agriculture, Food and Rural Development has a longstanding emphasis on preventing and controlling invasive weeds, insects, diseases and rodents that threaten agriculture. To get a better understanding of the problem in Alberta's natural areas, Alberta Sustainable Resource Development (ASRD) has asked the Alberta Research Council to assess which alien species present the greatest invasive risk.

"I think we need to take a very proactive approach toward risk assessment and prevention of introduction of invasive alien species," says ASRD's Dr. Christopher Shank. Risk assessment can include observing how a species has performed in other similar environments and evaluating predictors of invasiveness, such as whether a plant produces large numbers of seeds that migrate easily.

Garden plantings appear to be a major source of the province's infestations of purple loosestrife. This rapidly growing plant can choke out native riparian vegetation. The result is a dense stand of tall, purple-flowered plants that no bird, mammal or fish will eat.

Fortunately, Alberta's Purple Loosestrife Eradication Program is making progress in

controlling existing infestations and preventing new ones through public awareness, monitoring and various control methods. The horticultural varieties are no longer sold, and garden plantings have been reduced through the program's plant exchange component.

The program is lead by a multi-stakeholder committee. Sharing responsibility between agencies has been crucial to the program's success, says the committee's chair, Shafteek Ali of Alberta Agriculture. Although the weed does not threaten agricultural land, the department is involved because it has the infrastructure to promote and control weeds through the Weed Control Act and weed

inspectors (the agricultural fieldmen). The other stakeholder agencies also play key roles. For example, Ducks Unlimited Canada funds the program, and volunteers from the Alberta Native Plant Council do hand pulling to remove the plants.

Both Ali and Shank say that controlling any invasive species requires a long-term, ongoing commitment from all stakeholders. Shank says, "The only way we're going to address invasive species is cooperatively because no single person, agency, jurisdiction has the authority, expertise and funding to tackle the entire problem."

Aliens on the horizon

Dr. Cheryl Pearce of the University of Western Ontario and her co-researcher Dr. Derald Smith of the University of Calgary have been studying the spread of saltcedar and Russian olive for the last five years. These two riparian species, both currently planted in western Canada for various purposes, could pose a threat to our riparian ecosystems.

Take saltcedar, for example. It was introduced from Eurasia to North America in the mid-1800s. This pretty tree has feathery branches, bright pink flowers and a deadly effect on riparian habitats. Pearce says, "It spreads quickly and sometimes aggressively, doesn't provide habitat for wildlife, drops salts into underlying soils, and sucks up much water which is then evaporated through transpiration." It is tolerant of drought, heat and saline soils, and it is very difficult to control.

"Saltcedar loves to be killed basically – cutting seems to stimulate new growth as does application of chemicals; burning also stimulates new growth while killing surrounding native vegetation," says

Pearce. She adds, "We saw saltcedar growing quite happily in tailing ponds at a coal gasification plant in Montana. Chemicals had been applied to the foliage for 10 or so years until it appeared dead, but in the year with no herbicide application, new stems were being produced on the dead stems. It is one tough plant!"

She emphasizes that control is usually impossible once invasive alien species like Russian olive and saltcedar are well established. Prevention and constant vigilance are vital.

Based on her research, Pearce believes that saltcedar and Russian olive tend to invade riparian areas where native plant species are not doing well. She recommends using practices that help maintain native vegetation such as controlling cattle concentrations in riparian areas. As well, landowners, gardeners and people working near riparian areas need to know which species represent a potential threat so control measures can be taken before it is too late.

Alberta Canola Producers Commission

"Canola is good in our crop rotation, and
it's a healthy, consumer-valued product."

photo: Three Hills Capital



Being a part of AESA Council is a good fit for the Alberta Canola Producers Commission (ACPC). "We share like-minded goals with AESA, and we represent a large number of producers who produce a very high-value crop for Albertans," says Kenton Ziegler, chairman of the commission.

Those shared goals are clear from the ACPC's motto: Providing leadership for a vibrant, sustainable canola industry. The cornerstones of sustainability – economics and the environment – are key to both organizations.

Ziegler emphasizes the progressive attitude of ACPC and its board. The commission's research activities highlight that progressive approach. He says, "One example is innovative research into alternative uses of our crop including making bio-polymers out of canola oil. Bio-polymers can be used in anything from car parts to disposable cups." Another example is the ACPC's current five-year agreement with Agriculture and Agri-Food Canada for interdisciplinary research on integrated crop production and management.

The integrated crop management project has a strong focus on environmental sustainability, like many of ACPC's activities. For instance, as part of its producer education activities, the commission supports the annual Farm Tech conference, which includes sessions on environmentally responsible practices like reduced tillage.

Ziegler, who farms near Beiseker, says environmental stewardship is fundamental for all producers. "Our livelihood depends on the environment, but most important our families live in this environment. We must keep it healthy and sustainable."

Key environmental considerations for canola growers include "preservation of our soil, water and land resource, and nutrient management – just right fertilizer placement and rates," says Ziegler. He adds, "In everything that we do, we always consider the environmental impact. If we can spray less or fertilize just right, we do that every time."

Canola's environmental benefits are one of the two main reasons why Ziegler likes to grow this crop: "Canola is good in our crop rotation, and it's a healthy, consumer-valued product." He says that, in a crop rotation, canola helps to break up disease cycles and allows rotation of the different herbicide groups. And, for consumers, canola oil is a good source of Omega-3 fatty acids, very low in saturated fatty acids, and rich in vitamin E – characteristics that help reduce the risk of heart disease and fight cancer.

The Alberta Canola Producers Commission is represented on AESA Council by John Kubin. More information about ACPC is available at: <<http://www.canola.ab.ca>>.

ALBERTA food processors association

In 2004, the Alberta Food Processors Association will mark its 30th anniversary. Over those three decades, "the organization has changed dramatically," says Ted Johnston, President and CEO of AFPA. When it first started, the association's main purpose was "to promote the sale and consumption of Alberta manufactured food products within Alberta," he says. Today the industry focuses on markets well beyond the province's borders, and the association focuses on helping the industry to be world class.

AFPA is a non-profit organization representing all sectors of Alberta's food and beverage industry. Johnston says, "This industry is so vibrant and so critical to the economic well being of the province of Alberta. It's a very well kept secret that the food manufacturing sector is by far the largest manufacturing sector in the province."

AFPA's purpose is "to provide support services, programs and liaison with government departments, all aimed at improving the food manufacturing industry in Alberta," explains Johnston. A key role is to provide the training needed so companies can meet and exceed industry standards, grow their market share, and keep up with changing technologies.

The association also gives input on behalf of Alberta processors to a variety of agencies. For instance, it participates in lobbying the federal and provincial governments on international trade, and it is working with various partners throughout the beef industry on the BSE issue.

"We need to have a constant dialogue
between the primary producer and the
processing sector."

Along with international trade, producers and processors have many mutual concerns, including the environment. AFPA's membership on AESA Council provides a forum to discuss shared environmental issues such as water use and energy use.

Johnston says, "We need to have a constant dialogue between the primary producer and the processing sector. There are so many areas, not just in terms of the environmental side, where we need to be talking to each other to find the ways to ensure that every step along that chain is doing the things that are right for the industry."

He adds, "It's our belief, too, that a very strong agriculture-based manufacturing sector here in Alberta is one of the very best safety nets possible for our agriculture producers. If you've got good customers close by who add value to it, that value-added product is not usually subjected to the same level of price hammering that trying to sell straight commodities is."

The Alberta Food Processors Association is represented on the AESA Council by Frank Fallwell. For more information on AFPA, visit <www.afpa.com>.



The Science of Sustainability

A Fuller Perspective

Biodiversity and Sustainability

"...by taking a page out of nature's

playbook, we can begin to take advantage

of the successful strategy that nature has

used for millennia."

If we investigate how natural ecosystems are structured and how they function, we soon see that biodiversity is a key ingredient of these systems. Biodiversity is nature's mechanism to allow multiple interactions among organisms within an ecosystem. A natural ecosystem can be likened to a spider's web. Each node of the web represents a species of organism, and the threads of the web are the interactions among the various species. The interactions among species provide the stability to the system. These interactions are responsible for such things as population regulation, nutrient cycling, and efficient water and energy use.

Nature's strategy is to achieve diversity and a complexity of interactions so that the system's stability is maintained. This diversity is expressed at various scales: genetic diversity, field diversity and landscape diversity.

Natural systems are not dependent on human intervention. Left to their own devices, they do quite nicely and are able to survive for hundreds and thousands of years. This however cannot be said for modern agricultural systems. If we let agricultural land lay idle, over time nature's strategy to restore diversity will take over. Weeds and pioneering plant species appear, and the birds, insects, mammals, fungi and other organisms that use those plants for food and shelter begin to arrive.

Most modern agricultural production systems are not managed for diversity and complexity, but rather for homogeneity and simplicity. Genetic, field and landscape diversity are minimized within large or even vast

expanses of genetically homogeneous monocultures. Such systems run counter to nature's way of doing things.

Unlike natural systems, our production systems are not self-sufficient, particularly with respect to population regulation and nutrient cycling. They need human intervention to suppress natural diversity and complexity. And that intervention is associated with the expenditure of non-renewable energy resources, for example, fuel used to operate tillage equipment and energy used to manufacture pest control products.

Sustainable agricultural systems try to work with the natural tendency towards diversity and complexity. Research into sustainable agricultural systems asks the questions, "How can we make use of this tendency instead of trying to suppress it?"; "What are the advantages of increasing cropping system diversity?"; "How can natural nutrient cycling processes be incorporated into a sustainable agricultural system?"; and "How should we manage land to encourage diverse and active soil organism populations?"

Agricultural production systems will likely never be as diverse as natural ecosystems. However, by taking a page out of nature's playbook, we can begin to take advantage of the successful strategy that nature has used for millennia.



Dr. Les Fuller, P.Ag.
Chair, Environmentally Sustainable Agriculture
University of Alberta

Green Matters, Issue No. 17, Fall 2003

©AESACouncil, 2003

Green Matters is the newsletter of the Alberta Environmentally Sustainable Agriculture (AESAC) Council. AESAC Council consists of 29 representatives from Alberta's agriculture and food processing industry, environmental organizations and government. Its mandate is to: identify and evaluate environmental issues facing Alberta's agriculture and food processing industry; encourage the industry to proactively address these issues; advise the Alberta Minister of Agriculture, Food and Rural Development on these issues; and direct the AESAC Program.

The purpose of *Green Matters* is to provide a forum for discussion of environmental issues in Alberta's agriculture and food processing industry.

To subscribe to *Green Matters*, call 780-422-4385. *Green Matters* is also available online at <http://www1.agric.gov.ab.ca>

Editorial Board: John Kolk, Bruce Beattie, Terry Rachuk
Editor: Roger Bryan
Contributors: Carolyn King, John Kolk, Les Fuller
Design and Typesetting:
P40 Visual Communications

Alberta
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT



Alberta Environmentally Sustainable
Agriculture Program